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MEMOIRS
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*Figures and Descriptions*

ILLUSTRATIVE OF  
BRITISH ORGANIC REMAINS.

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DECADE IV.  
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BRITISH FOSSILS.

DECADE THE FOURTH.

ALL the plates and descriptions in this Decade are devoted to fossil Echinodermata of the order *Echinoidea*.

The genera selected for illustration are *Temnechinus*, *Acrosalenia*, *Hyboclypus*, *Hemipneustes*, *Ananchytes* with its section *Holaster*, and *Cardiaster*. The geological age of the first is Upper Tertiary, of the second and third Oolitic, of the remainder Cretaceous. Several of the species are represented for the first time.

Temnechinus is a genus remarkable for its species being at present known only as fossils of the Coralline and Red Crag; it is now characterized for the first time.

The examples of *Acrosalenia* selected are both remarkable for their beauty and their very perfect condition. They are also of much interest, one on account of the rectification of its true generic position, which I have been enabled to make through the aid afforded by very perfect specimens: the other, because of the complete preservation exhibited by the specimens described of parts too often lost in fossil Echinoderms. I have appended to the descriptions of these *Acrosalenia* brief characters of some new species of this interesting oolitic genus.

Hyboclypus is illustrated by the finest and largest species of the genus, one discovered during the researches of the Geological Surveyors.

Hemipneustes, to which genus I unite *Toxaster*, is now for the first time authentically represented by a British example, remarkable for its novelty and for the light it throws upon the mutual affinities of those genera of *Echinoidea* which have excentric mouths.

The well known genus *Ananchytes* is combined (as indeed it was formerly by Lamarek) with *Holaster*. In selecting the common *Ananchytes ovata* of the Chalk for the subject of a plate and description, I have been influenced by the necessity of clearing up the confused synonymy of this fine fossil, and of settling the numerous spurious species which have been constituted out of its varieties, or from imperfect figures contained in old works.

Cardiaster is a new genus, lately constituted by myself for some remarkable and interesting sea-urchins, intermediate in their characters between *Ananchytes* and the true *Spatangida*. To the account of the species figured I have added notices of all the forms of this curious type which are known to me as British.

EDWARD FORBES.

October, 1852.

BRITISH FOSSILS.

DECADE IV. PLATE X.

CARDIASTER EXCENTRICUS.

[Genus CARDIASTER. FORBES (1850). (Sub-kingdom Radiata. Class Echinodermata. Order Echinoidea. Family Ananchytidæ.) Body cordate, tumid, or depressed; lateral ambulacra having the upper part of the avenues slightly dissimilar; all the ambulacra convergent on the vertex, the anterior one lodged in a strongly marked sulcus with angulated sides. A fasciole passing beneath the anus and continued on the sides. Apical disk elongated and composed of four perforated genital and five perforated ocular plates. Tubercles perforate, their bosses crenulate. No dental apparatus.]

DIAGNOSIS. *C. ambitu ovato-cordato, dorso elevato declivente, sulco antico profundo sub-verticali; vertice valde excentrico; extremitate anali truncato, imminente.*

SYNONYMS. *Spatangus excentricus*, ROSE, in Woodward's Geology of Norfolk, p. 27, pl. 1, f. 5. (1833.) *Cardiaster excentricus*, FORBES, Ann. Nat. Hist. 2d series, vol. vi. p. 443.

This singular sea-urchin is of an oblong outline, truncated behind, deeply notched by the anteal sulcus in front, and having its widest portion in front of the anterior third of its width. The dorsal surface is very high anteriorly, the walls of the anteal sulcus rising nearly perpendicularly to the highest part of the body immediately in front of the apical disk. From the point of its greatest elevation the back gradually declines in a nearly straight line, forming a long sub-carinated ridge, until it reaches the posterior truncated extremity at about half the height of the entire body. On each side of the centre of the back the sides fall away steeply, but the margins of the body are rounded, and, in the antero-lateral regions, tumid. The posterior truncation in some specimens inclines at a gentle angle. The under surface is gently rounded and somewhat convex.

The anterior ambulacrum is lodged in a deep sulcus with sharply angulated sides. The bottom of this furrow is rounded, and covered with minute granules but no tubercles. The ambulacral pores are inconspicuous; they become close-ranked in the upper portion. The uppermost portion is reflected on the back with a rapid curve, and includes about six of the vertical rows of pairs of pores. It

joins the apical disk a little in front of the tips of the antero-lateral ambulacra. These are placed very far forward, and run down upon the most tumid portion of the body. In a large specimen as many as thirty pairs of pores may be counted in these rows, between the apex and the margin. The avenues are at the surface of the test, and the pairs of pores of their outer rows are a very little wider than the inner ones. The postero-lateral ambulacra are even less conspicuous; they diverge greatly from the antero-laterals, and form together a very acute angle. Their uppermost portion consists of closely set pairs of pores; on their posterior portions the pairs of pores become very indistinct.

The plates on the margins of the anteal sulcus are thickly studded with small primary tubercles, which are very numerous also on the cheeks, but become few and scattered on the dorsal surface. They are perforated, and placed on crenulated bosses. The fasciole is distinctly marked, passing under the vent, and continued on each side even over the cheeks. The vent is large and perpendicularly ovate, its widest diameter uppermost; the area in which it is placed is either quite plane or slightly excavated.

On the under surface the mouth is seen near the anterior extremity, in front of the widest portion of the test; it is comparatively small and transversely oblong, the hinder lip is highest. On the ambulacral portions of the base there are very few or no tubercles, but a considerable number, and those rather large, on the shield-shaped inferior portion of the odd interambulacrum. In all the specimens that I have seen the base is much abraded. Young examples are rather more elevated than old ones. In one of Mr. Rose's specimens, however, a flint cast from Swaffham, $\frac{1}{12}$ ths of an inch in length, nearly the same proportions are shown as in an example of twice the size. The most perfect specimen, in point of completeness of outline, that I have seen, measures one inch and ten-twelfths in length, by one inch and four-twelfths in breadth. Its anterior extremity is one inch and three-twelfths, and its posterior nine-twelfths of an inch in height.

Locality and Geological Position. First observed by Mr. Rose of Swaffham, and communicated by him to Mr. Samuel Woodward, in whose *Geology of Norfolk* it was briefly noticed, and slightly but characteristically figured. It is recorded by these geologists from the Upper and Medial Chalk of Norfolk. Mr. Bowerbank possesses a fine flint cast showing the plates. This description is drawn up chiefly from Mr. Rose's original examples and Mr. Bowerbank's specimen, all kindly lent for the purpose, and from a fine, but imperfect,

specimen presented to the Museum of Practical Geology by my friend Mr. C. F. Cockburn of the Royal Artillery, who found it in the White Chalk at Dover.

II.

CARDIASTER ROSTRATUS.

DIAGNOSIS. *C. testá lateraliter compressá, apice in rostrum elongatum elevatumque producto.*

For some time I was under the impression that this extraordinary and anomalous little urchin of which specimens were kindly communicated by Mr. Bowerbank, Mr. Wetherell, and Mr. Woodward, was the young of the *Cardiaster excentricus*, different as its outline is. The series of specimens of various sizes of the latter species shown me by Mr. Rose, (who has also found the kind now figured,) convinces me that it is necessary to regard this beaked and *Neæra*-like form of *Cardiaster* as distinct. All the examples are impressed with the same peculiarities. The number submitted to me has been seven, including fragments; and in addition to those lent for examination are two fine specimens, one of them nearly entire, found by Mr. Cockburn in the Chalk with Flints at Bostal Heath, near Plumstead, and generously presented by that gentleman to the Museum of Practical Geology.

The striking feature of this form is the rhomboidal profile which it exhibits in consequence of the obliquity of the anteal and posteaal truncations, both inclining forwards at considerable angles. The anteal ambulacral sulcus is very deep, long, and narrow; it rises obliquely to a great height in consequence of the elevation of the apical disk upon a sort of beak. The genital plates are assembled just below its summit, which is notched by the turning over, as it were, of the anteal furrow. The details of the lateral ambulacra, in consequence of their being completely plane and very obscure, can with difficulty be distinguished. The rostrum bends forward slightly in its upper part. The summit of the back is more or less sharply carinated, and declines rapidly with a faint concave curve, until it terminates in the summit of the very oblique and rapidly declining posterior truncation, in the uppermost part of which, at rather less than the total height of the body, is the anus, placed at one end of a groove. The whole of the dorsal surface of the test is covered with granules interspersed with scattered minute tubercles, which become more numerous on the slightly tumid cheeks. The fasciole is strongly and distinctly marked,

and passes from beneath the anus over the cheeks. The base is flattened, and, except on the ambulacral spaces, is strongly tuberculated. The mouth is very small and far forward.

The largest specimen which I have seen measures $\frac{8}{12}$ ths of an inch in length of base; $\frac{6}{12}$ ths in breadth; $\frac{5}{12}$ ths in height at the anal truncation, and when perfect must have been $\frac{10}{12}$ ths in height at the anteal sulcus.

Locality and Geological Position. In the Chalk with Flints of Kent and Norfolk.

DESCRIPTION OF THE PLATE.

CARDIASTER EXCENTRICUS. Figs. 1-18.

Figs. 1. 2. and 3. Different views of a silicified specimen in the cabinet of Mr. Bowerbank.

Figs. 4. 5. and 6. Outlines of a large flint cast, very perfect, in the collection of Mr. Rose. This is the original of the figure in the *Geology of Norfolk*.

Fig. 7. Anterior extremity of a large specimen in which the test is preserved, in the cabinet of Mr. Rose.

Figs. 8. 9. Half grown example, somewhat crushed, in the cabinet of Mr. Wetherell.

Figs. 10. 11. and 12. Anterior and posterior views and side profile of small specimen in Mr. Rose's collection.

Fig. 13. Outline of a young example in Mr. Rose's cabinet. A flint cast.

Figs. 14. and 15. Details of the test and of the apical disk as exhibited on flint casts.

Fig. 16. Outline of the under surface.

Fig. 17. Tubercles and granules from a specimen in the Museum of Practical Geology.

Fig. 18. Cheeks, with a part of the fasciole.

CARDIASTER ROSTRATUS. Figs. 19-24.

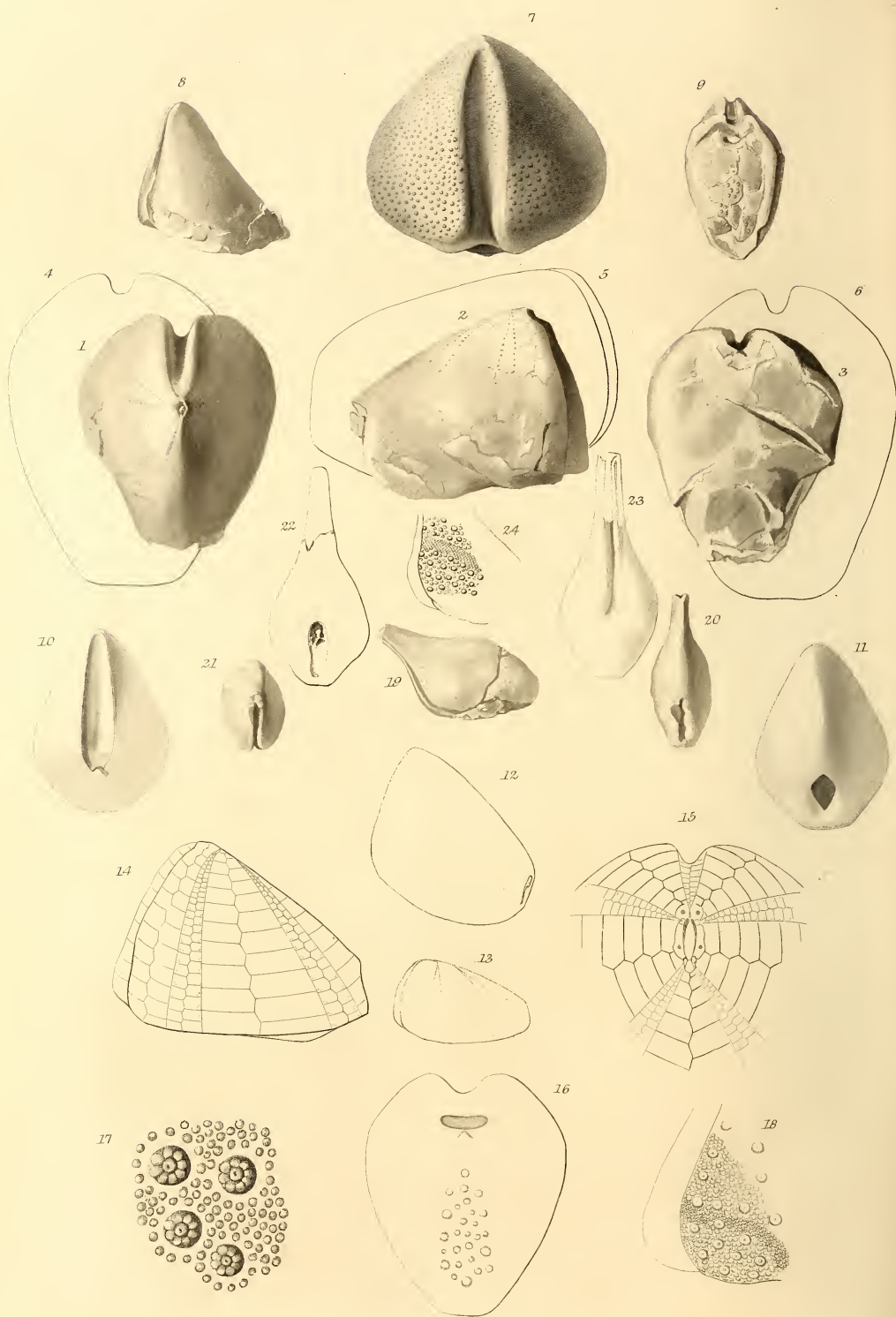
Figs. 19. 20. and 21. Different views of a specimen from the chalk near Plumstead, presented by Mr. Cockburn to the Museum of Practical Geology.

Figs. 22. and 23. Outline partly restored of a large specimen from Norfolk in Mr. Rose's collection.

Fig. 24. Cheeks and part of fasciole.

EDWARD FORBES.

October, 1852.

Figs. 1-18 *CARDIASTER EXCENTRICUS*—Rose.19-24 *CARDIASTER CAUDATUS*—Forbes.